

## AWARENESS ABOUT RADIATION INDUCED BYSTANDER EFFECT AMONG ALLIED HEALTH SCIENCE STUDENTS

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### Abstract

**Introduction:** The radiation-induced bystander effect (bystander effect) is the phenomenon in which unirradiated cells exhibit irradiated effects as a result of signals received from nearby irradiated cells. Cells are irradiated, and the medium is transferred to unirradiated cells, these unirradiated cells show bystander responses when assayed for clonogenic survival and oncogenic transformation. This is also attributed to the bystander effect. **Aim:** This survey was conducted for assessing the awareness about the radiation induced bystander effect among Allied Health Science. **Materials and method:** A cross-section research was conducted with a self-administered questionnaire containing ten questions distributed amongst 100 Allied Health Science students. The questionnaire assessed the radiation induced bystander effect among Allied Health Science Students. The responses were recorded and analyzed. **Results:** 60.9% respondents were aware about bystander effect. 52.2% were aware of in radiology that only direct radiation exposure to genetic material of nucleus cause damage to cells. 65.2% were aware of radiation induced bystander effect. 46.4% were aware of distant bystander effect is proved to be excited outside of radiation field according to in vivo studies. 58.4% were aware of the mechanisms involved in the bystander effect. **Conclusion:** There is a limited awareness amongst Allied Health Science students about Radiation induced bystander effect Enhanced awareness initiatives and educational programmes together with increased importance for curriculum improvements that further promote knowledge and awareness of radiation induced bystander effect among Allied Health Science Students.

**Keywords:** Awareness, Students, Repair, Radiation.

### INTRODUCTION

Traditionally it was believed in radiobiology that only direct radiation exposure to genetic material of nucleus causes damage to cells. This model predicts that radiation-induced mutations are created in irradiated area during a short time after irradiation. This dogma was challenged in 1992 with an experiment performed by nagasawa. This experiment revealed that irradiation of 1% cells with alpha particles lead to chromatid exchange in more than 30% of cells. This is called as bystander effect which demonstrates the relationship between irradiated and non-irradiated cells .[1]

Bystander effect is more obvious in cells with gap junction. Therefore, intercellular relationships between cells is an necessary requirement to transfer signals of radiation-induced bystander effect . Distant Bystander effect is proved to be existed outside of radiation field according to in-Vivo studies. Local irradiation to a small area

of body causes chromosomal damages and changes in the cell and molecule levels of distant tissues[2]

After a local irradiation, the chromosomal breaks, P53 activity, DNA repair enzymes, mitotic death and apoptosis of distant tissues from radiation target would impressively increased These signs are a threat for carcinogenesis due to radiation induced bystander effect.

Mancuso and their teammates found that irradiated mice with high sensitivity increase induced medulloblastoma cancer associated with chromosomal damages and abnormalities apparently[4]

It is supposed that local radiation to an area, like what is seen in radiotherapy, could cause systemic damages and even lead to carcinogenesis incidence beyond the therapy field. An example of secondary cancer which is attributed to this phenomenon is high incidence of lung cancer among people who have had radiation therapy to treat prostate cancer [5]

Mechanisms involved in establishing the bystander effect or the radiation effect of outside therapy field include immune system, Free radicals, oxidative stress, changes in gene expression of inflammation pathway and epigenetic modulators[6] This survey was conducted for assessing the awareness about the radiation induced bystander effect among Allied Health Science.

## **MATERIALS AND METHOD**

This cross-sectional research was conducted with a self-administered questionnaire containing ten questions distributed amongst 100 Allied Health science students. The students were randomly selected across various disciplines of Allied Health Sciences. The study setting was designated in the university campus. The survey instrument was a questionnaire pre tested and evaluated for validity and reliability concerns.

The questionnaire included ten questions eliciting the demographic data through open ended responses and multiple choice questions for the other responses. The study was approved by the Institutional Ethical Committee and informed consent was obtained from the participants. The questionnaire was posted on an online platform and the identity of the respondents were kept confidential.

The questionnaire assessed the Awareness about among Allied Health Science Students. The responses were recorded and analyzed. There were no incomplete responses and no dropouts from the study. The final data obtained was organized, tabulated and subjected to statistical analysis.

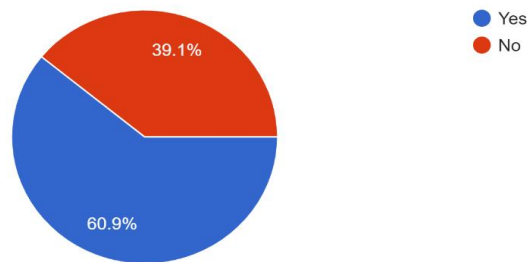
The salient questions in the study are:

1. Are you aware of bystander effect.
2. Does it was believed in radiology that only direct radiation exposure to genetic material of nucleus cause damage to cells.
3. Are you aware of radiation induced bystander effect.
4. Does distant bystander effect is proved to be excited outside of radiation field according to in vivo studies .
5. Do you aware of the mechanisms involoved in the bystander effect .

## RESULT

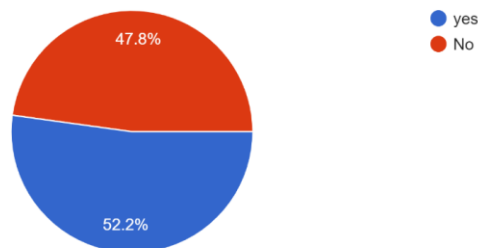
60.9% respondents were aware about bystander effect. 52.2% were aware of in radiology that only direct radiation exposure to genetic material of nucleus cause damage to cells. 65.2% were aware of radiation induced bystander effect. 46.4% were aware of distant bystander effect is proved to be excited outside of radiation filed according to in vivo studies.58.4% were aware of the mechanisms involved in the bystander effect.(Fig 1-5)

Are you aware of bystander effect  
138 responses



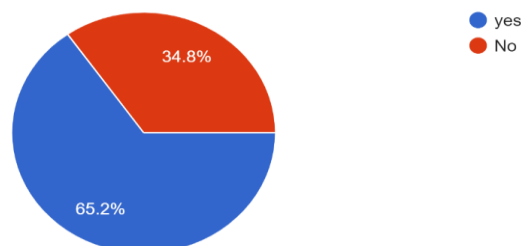
**Figure 1 : Aware About Bystander Effect**

Does it was believed in radiology that only direct radiation exposure to genetic material of nucleus cause damage to cells  
138 responses



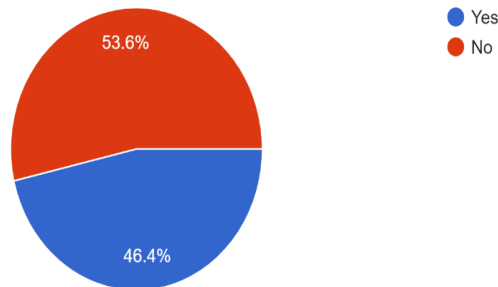
**Figure 2 : Aware of in Radiology That Only Direct Radiation Exposure To Genetic Material Of Nucleus Cause Damage To Cells**

Are you aware of radiation induced bystander effect  
138 responses



**Figure 3: Were Aware of Radiation Induced Bystander Effect**

Does distant bystander effect is proved to be excited outside of radiation field according to in vivo studies  
138 responses



**Figure 4: Were Aware of Distant Bystander Effect is Proved to be Excited Outside of Radiation Filed According to in Vivo Studies**

## DISCUSSION

Ionizing radiation is a well established human carcinogen. Established dogma has relied on the assumption that DNA of the nucleus is the main target for radiation-induced genotoxicity and carcinogenesis. At doses above 50 millisievert, the radiation-induced cancer risk can be estimated based on the cancer incidence among the Japanese atomic bomb survivors adiation-induced bystander effect is defined as the induction of biological effects in cells that are not directly traversed by a charged particle but are in close proximity to cells that are, or have received signals from, these irradiated cells[7]. 60.9% respondents were aware about bystander effect

There is evidence that very low doses of  $\alpha$ -particles induced clastogenic responses in both Chinese hamster ovary (CHO) and human fibroblast cultures at levels significantly higher than expected based on the number of cellular nuclei that had been traversed by a particle[8]. 52.2% were aware of in radiology that only direct radiation exposure to genetic material of nucleus cause damage to cells.

There is also evidence that media from irradiated culture (upon transferal to nonirradiated cells) can induce biological effects in the latter. Mothersill and Seymour first demonstrated a highly significant reduction in cloning efficiency in both non irradiated normal as well as malignant epithelial cell lines that had received media from  $^{60}\text{Co}$ - $\gamma$ -ray-irradiated cultures[9]

In feeder layer culture, metabolic cooperation between cells of similar or different types increases the clonogenic survival of the non irradiated cells by providing growth factors and matrix support and is considered a positive aspect of the bystander phenomenon[10]. 65.2% were aware of radiation induced bystander effect.

These results provide evidence that the COX-2 signaling pathway, which is essential in mediating a cellular inflammatory response, may be a critical signaling event for producing a bystander effect[11]. 46.4% were aware of distant bystander effect is proved to be excited outside of radiation field according to in vivo studies

## CONCLUSION

This is a limited awareness among Allight health science students about radiation induced bystander effect. Enhanced awareness initiatives and educational programmes together with increased importance for curriculum improvements that further promote knowledge and awareness of radiation-induced bystander effect among Allied Health Science Students.

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